

Memo	Unintended Activations of Sprinkler and Water Mist Systems in Heritage - Norwegian Record	COWI AS Otto Nielsens veg 12 Postboks 2564 Sentrum NO-7414 Trondheim Norway
Date	12 Jun. 2005	Tel +47 73 89 60 00 Fax +47 73 89 60 01 www.cowi.no
To	Riksantikvaren - The Norwegian Directorate for Cultural Heritage (RNDCH)	
From	Geir Jensen, Arvid Reitan. COWI AS	

This is a list of registered incidents of water damage from unintended activations of sprinkler and water mist installations in Norway from 1985 to present.

The list is based on known incidents from routine inspections of 148 sprinkler indoor and outdoor systems of wet, dry, special and water mist categories in wooden churches, plus a few that has been reported by newspapers or other.

All installations are in heritage buildings. In excess of 90 % of these cover areas that are wholly or partially exposed to sub-zero (freezing) temperatures.

Sprinkler Systems

INCIDENT (Unintentional activation)	LOCA- TION	YEAR	CAUSE	DAMAGE
1 Outdoor water spray penetrating eaves	Røldal	1986	On-site test de luge sprinkler	Water on painting. Minor damage.
2 Sprinkler activated at bell tower building	Høre	1988	Faulty non-return valve	None reported
3 Leaking sprinkler pipe	Høre	1991	Condensed water freezing at weak joint.	None reported.
4 Leaking dry sprinkler pipe, valve activated.	Urnes	1991	Faulty routine. Leaking valve.	Minor (report by H Skaug)
5 Leaking sprinkler pipe	Høre	1993	Condensed water freezing	Not clear. Valve shut after 60 mins.
6 Sprinkler activated at bell tower building	Høre	1994	Faulty non-return valve	Minor or none
7 Sprinkler activated at bell tower building	Høre	1995	Faulty back-flow preventer	Minor or none

8	Façade deluge system activated	Kaupanger	1996	Pipe joint slide	None reported
9	Façade deluge system activated	Flesberg	1998	Wrong valve settings	Minor, façade wetting only
10	Sprinkler room pipe rupture	Nore	1998	Pipe joint broke	Room flooded. Dry valve activated and filled pipes in church.
11	Façade deluge system activated	Hopperstad	1999	Air leakage in pneumatic line detector. Failed manual response and maintenance.	Water penetrated gap, ran into church nave and froze. No long term damage.
12	Façade deluge system activated	Lomen	1999	Badger cut off double knock pneumatic line detectors	None or minor damage
13	Pipe joint leakage at sprinkler nozzle	Hegge	1999	Condensed water was not drained as per maint. routine.	Water froze, ruptured joint and caused air leakage. Sound alerted personnel who closed valve. No damage.
14	Façade deluge system activated	Torpo	1999	Air leakage in pneumatic line detector. Compressor failure. Delayed manual response.	No damage.
15	Indoor preaction system activated. Pipe end opened.	Borgund	2001	Double knock optical smoke alarms were improperly acted upon, as a hospital emergency arised	As dry system filled, a pipe end broke open, and a missing nozzle open joint sprayed considerable amounts of water in church nave. Moderate irreversible damage.
16	Façade deluge system activated	Hedalen	2001	Double knock line heat detectors set in state of alarm when tested.	No reported damage.
17	Façade deluge system activated	Hedalen	2001	Wrongly installed valve could not be fully drained. Water froze.	No reported damage. The incident was result of faulty repair of previous incident above.

18	Outdoor irrigation monitors protecting church activated	Eidsborg	2002	Air leakage at control valve of pneumatic line detection. Valve not 100 % split for double knock. Soiled water.	Minor damage. Breezeways heavily wetted. Incident revealed that the type of monitors is unsuitable for this application. Detection valve was reworked.
19	Façade deluge system activated	Heddal	2003	Electric line heat detector triggered by maintenance. Improper manual response.	No reported damage.
20	Façade deluge system activated	Lom	2004	Double knock electric line heat detectors activated at maintenance.	No reported damage.

Water Mist Systems

	Water mist deluge in church attic activated	Rollag	1998	Air leakage in pneumatic line detector	Limited water reservoir emptied (designed to avoid damage*). None or minor damage
	Water mist nozzle activated in hotel room	Kong Carl	1999	Guests broke nozzle bulb.	Dried quickly, no interior or other damage.
	Water mist smoke scrubbing system activated in computer room. Emptied reservoir.	Bibsys	2000	Welding smoke triggered smoke detectors.	Computers ran throughout - no damage. Borderline of real demand vs unintentional.
	High pressure deluge water mist activation indoor.	Gol	2002	Single knock pneumatic line detection pipe broke. Below zero temp.	Water mist produced snow. Church nave was cleaned by shoveling and brushing snow. No damage reported. (Double knock system from 2003)
	High pressure water mist deluge zone activated.	Tanum	2002	Suspected fault in detection algorithm.	Substantial water damage in church. (System not yet commissioned - delayed valve shut off)

** Limited water reservoir volume deliberately designed to equal the absorption capability of the attic floor insulation, in order to avoid run off to impact water soluble wall and ceiling decorations in church nave. The incident proved the design was successful.*

Extract from: “Water Mist for Protection of Heritage”, Interconsult (COWI)
(these incidents are included in above listing)

UNINTENTIONAL SYSTEM ACTIVATION: 4 INCIDENTS

- 1 + Bibsys** Smoke scrubbing & extinguishing water mist system in **computer room**. Activated by welding. Computers were running, no damage. System considered for **museum vaults**.
- 2 + Kong Carl** Historic **hotel**. Medium pressure water mist. Broken bulb activated nozzle in guest room. *“Never seen a room so perfectly wet; still, no water running or dripping. Dried quickly, no damage to interior”*, manager said. *“Nice fitted and unobtrusive”*.
- 3 + Rollag** **Attic**. Mist system designed to flashover suppression. Limited volume of water designed to be absorbed by insulation of attic floor - to avoid damage to decorated room below. Activated by lightning strike. Worked as designed - no decor damage.
- 4 - Tanum** **Church**. Faulty activation of deluge zone of high pressure water mist system. System was not yet commissioned by fire brigade. Therefore, 30 min to find shut off valve. Substantial water damage. High grade system, but detection algorithm questioned.



Registered Full Scale On-Site Tests of Sprinkler and Water Mist Systems in Stave Churches

- | | | |
|----|-----------|---|
| 1 | Borgund | Indoor dry and outdoor deluge façade, sprinkler systems |
| 2 | Torpo | Indoor dry high pressure water mist, and outdoor deluge sprinkler |
| 3 | Reinli | Indoor dry low pressure water mist, and outdoor deluge spinkler |
| 4 | Haltdalen | Indoor and outdoor dry low pressure water mist, zoned deluge. |
| 5 | Uvdal | Outdoor façade sprinkler systems, zoned deluge |
| 6 | Nore | Outdoor façade sprinkler systems, zoned deluge |
| 7 | Rollag | Outdoor façade sprinkler systems, zoned deluge |
| 8 | Flesberg | Outdoor façade sprinkler systems, zoned deluge |
| 9 | Lomen | Outdoor façade sprinkler systems, zoned deluge |
| 10 | Eidsborg | Outdoor ‘irrigation’ monitors to protect roof, façade, breezeways |

Tests are logged for maintenance records only. A few are reported on (Norwegian). Tests were evaluated on-site by key personell for refining designs.